Customer No. 24498
Internal Docket No. PD040023
Office Action Date: 06/18/2009

Listing and Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

1.   (currently amended) Method, comprising: ~~for transforming in an audio signal processor a digital audio signal from the time domain into a different domain, said method including the steps:~~

-    receiving by an audio signal processor a digital audio signal in the time domain; and

-    transforming by the audio signal processor the digital audio signal from the time domain into a different domain, comprising:

-    forming partitions of transform length N from said digital audio signal, which partitions overlap by N/2, wherein N is an integer multiple of '4', ~~comprising:~~

-    performing a multiplication of a transform matrix Mh, said transform matrix having a size of N/2 rows and N columns, with each one of said partitions such that succeeding transformed signal partitions are provided,
wherein said transform matrix is constructed in the form:

$$Mh = [a \ lr(a) \ b \ lr(-1^*b)],$$

wherein 'a' and 'b' are sub-matrices each having N/2 rows and N/4 columns and including '+1' and '-1' values only,
and wherein ~~said sub-matrices are linearly independent~~ lr() means that columns or elements of a sub-matrix are reversed in order,
and wherein 'a' and 'b' are chosen such that a matrix

$$MhFull = \begin{bmatrix} a \ lr(a) & b \ lr(-1^*b) \\ b \ lr(-1^*b) & a \ lr(a) \end{bmatrix}$$ has the rank N,

whereby said transform matrix multiplication outputs N/2 output values per N input values representing a subsampling by a factor of '2', thereby forming a transformed digital audio signal.

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2. (currently amended) Method for inversely transforming ~~in an audio signal processor~~ a ~~transformed~~ digital audio signal ~~into the time domain~~, which ~~transformed~~ digital audio signal was constructed by the steps:

- forming partitions of transform length N from an original digital audio signal, which partitions were overlapping by N/2, wherein N is an integer multiple of '4';

- performing a multiplication of a transform matrix M<u>h</u>, said transform matrix ~~Mh~~ having a size of N/2 rows and N columns, with each one of said partitions (x) such that succeeding transformed signal partitions were provided, wherein said transform matrix was constructed in the form Mh = [a lr(a) b lr(-1*b)], wherein 'a' and 'b' were sub-matrices each having N/2 rows and N/4 columns and including '+1' and '-1' values only,

and wherein ~~said sub-matrices are linearly independent~~ <u>lr() means that columns or elements of a sub-matrix were reversed in order,</u>

<u>and wherein 'a' and 'b' were chosen such that a matrix</u>

<u>MhFull =</u> $\begin{bmatrix} a\ lr(a) & b\ lr(-1^*b) \\ b\ lr(-1^*b) & a\ lr(a) \end{bmatrix}$ <u>has the rank N,</u>

whereby said transform matrix multiplication had output N/2 output values per N input values representing a subsampling by a factor of '2', thereby having formed a transformed digital audio signal,

said method including the steps:

- <u>receiving by an audio signal processor the digital audio signal; and</u>

- <u>transforming by the audio signal processor the digital audio signal into the time domain, comprising:</u>

- performing a multiplication of an inverse transform matrix invMh, said inverse transform matrix having a size of N rows and N/2 columns, with each one of said transformed signal partitions such that succeeding inversely transformed signal partitions of length N are provided, wherein said inverse transform matrix invMH is constructed by taking the left half of the inverse of ~~a~~ <u>the</u> matrix

$\begin{bmatrix} a\ lr(a) & b\ lr(-1^*b) \\ b\ lr(-1^*b) & a\ lr(a) \end{bmatrix}$,

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wherein 'a' and 'b' are sub-matrices as defined above;

- assembling said inversely transformed signal partitions in an overlapping manner so as to form an inversely transformed digital audio signal, whereby said overlapping is of size N/2,
and whereby the samples values of said inversely transformed signal partitions, or the samples values of said inversely transformed digital audio signal, or the values of said transformed signal partitions are each scaled by multiplication with factor '1/N' or by a division by 'N' or by a corresponding binary shift operation.

3. (currently amended) Apparatus for transforming a digital audio signal from the time domain into a different domain, said apparatus including:

- means which form partitions of transform length N from said digital audio signal, which partitions overlap by N/2, wherein N is an integer multiple of '4';
- means which perform a multiplication of a transform matrix Mh, said transform matrix having a size of N/2 rows and N columns, with each one of said partitions such that succeeding transformed signal partitions are provided, wherein said transform matrix is constructed in the form:

$$Mh = [a \; \text{lr}(a) \quad b \; \text{lr}(-1^*b)] \, ,$$

wherein 'a' and 'b' are sub-matrices each having N/2 rows and N/4 columns and including '+1' and '-1' values only,
and wherein ~~said sub-matrices are linearly independent~~ <u>lr() means that columns or elements of a sub-matrix are reversed in order,</u>
<u>and wherein 'a' and 'b' are chosen such that a matrix</u>

$$\text{MhFull} = \begin{bmatrix} a \; \text{lr}(a) & b \; \text{lr}(-1^*b) \\ b \; \text{lr}(-1^*b) & a \; \text{lr}(a) \end{bmatrix} \text{ has the rank N,}$$

whereby said transform matrix multiplication means output N/2 output values per N input values representing a subsampling by a factor of '2', thereby forming a transformed digital audio signal.

4. (currently amended) Apparatus for inversely transforming a transformed digital audio signal into the time domain, which transformed digital audio signal was constructed by the steps:

- forming partitions of transform length N from an original digital audio signal, which partitions were overlapping by N/2, wherein N is an integer multiple of '4';

- performing a multiplication of a transform matrix <u>Mh</u>, said transform matrix ~~Mh~~ having a size of N/2 rows and N ~~rows~~ <u>columns</u>, with each one of said partitions such that succeeding transformed signal partitions were provided,

   wherein said transform matrix was constructed in the form Mh = [a lr(a) b lr(-1*b)], wherein 'a' and 'b' were sub-matrices each having N/2 rows and N/4 columns and including '+1' and '-1' values only,

   and wherein ~~said sub-matrices are linearly independent~~ <u>lr() means that columns or elements of a sub-matrix were reversed in order,</u>

   <u>and wherein 'a' and 'b' were chosen such that a matrix</u>

   $$\underline{MhFull = \begin{bmatrix} a\ lr(a) & b\ lr(-1^*b) \\ b\ lr(-1^*b) & a\ lr(a) \end{bmatrix} \text{ has the rank N,}}$$

   whereby said transform matrix multiplication had output N/2 output values per N input values representing a subsampling by a factor of '2', thereby having formed a transformed digital audio signal,

   said apparatus including:

- means which perform a multiplication of an inverse transform matrix invMh, said inverse transform matrix having a size of N rows and N/2 columns, with each one of said transformed signal partitions such that succeeding inversely transformed signal partitions of length N are provided,

   wherein said inverse transform matrix invMH is constructed by taking the left half of the inverse of ~~a~~ <u>the</u> matrix

   $$\begin{bmatrix} a\ lr(a) & b\ lr(-1^*b) \\ b\ lr(-1^*b) & a\ lr(a) \end{bmatrix},$$

   wherein 'a' and 'b' are sub-matrices as defined above;

- means which assemble said inversely transformed signal partitions in an overlapping manner so as to form an inversely transformed digital audio signal, whereby said overlapping is of size N/2,

   and whereby the samples values of said inversely transformed signal partitions, or the samples values of said inversely transformed digital audio

signal, or the values of said transformed signal partitions are each scaled by multiplication with factor '1/N' or by a division by 'N' or by a corresponding binary shift operation.

5. (previously presented) Method according to claim 1, wherein N equals '8'.

6. (previously presented) Method according to claim 5, wherein said transform matrix has the values:

$$
Mh = \begin{bmatrix} 1 & 1 & 1 & 1 & -1 & 1 & -1 & 1 \\ 1 & 1 & 1 & 1 & 1 & -1 & 1 & -1 \\ 1 & -1 & -1 & 1 & -1 & -1 & 1 & 1 \\ 1 & -1 & -1 & 1 & 1 & 1 & -1 & -1 \end{bmatrix},
$$

and said inverse transform matrix has the values:

$$
invMh = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ 1 & 1 & -1 & -1 \\ 1 & 1 & 1 & 1 \\ -1 & 1 & -1 & 1 \\ 1 & -1 & -1 & 1 \\ -1 & 1 & 1 & -1 \\ 1 & -1 & 1 & -1 \end{bmatrix}.
$$